REMARKS

At the outset, the Applicant wishes to thank Patent Examiner Roger Pang for the many courtesies extended to the undersigned attorney during the Personal Interview on June 30, 2004, at the U.S.P.T.O. The substance of this Personal Interview is set forth in this Amendment and in the Examiner Interview Summary.

Claim 8 has been amended to correct a minor typographical error relating to "i = 4".

Concerning the Office Action objection to the drawings, the Patent Examiner, during the Personal Interview, has suggested that the previously submitted modified FIG. 1 and FIG. 2 of the drawings be resubmitted. Then, the Patent Examiner suggested submitting a new FIG. 2a and a new FIG. 2b which show the gears 7a, 7b, 7c, 7d, for FIG. 2b and gears 11a, 11b, 11c, and 11d for FIG. 2a. This is now being done in this Amendment, by the amendments to the drawings. Also, the Specification on Pages 2 and 6 has been amended to refer to newly added Figs. 2a and 2b.

With regard to the possibility for overcoming the prior art rejections, the Patent Examiner suggested during the Personal Interview that either Comparative Testing or testing based upon

formulas be carried out with the prior art of records. The results would be submitted in the form of a Declaration Under Rule 132. It was suggested during the Personal Interview that this testing and the results be directed to the technical areas of the claimed gear ratios which should be shown to be novel. Also, testing should include testing with regard to the torque that is transmitted by the transmission when in service, compared to the prior art transmission structures. The Patent Examiner stated that it will be necessary to achieve unexpected results and to make a convincing showing set forth in the Declaration Under Rule 132 in order to rebut the presumption of obviousness over the prior art and in order to prove patentability for the claimed invention.

A proposed and unexecuted Declaration Under Rule 132 is enclosed herewith. The executed document will be filed as soon as possible in the future.

The Patent Examiner has rejected claim 9 under 35 U.S.C. 103 as being unpatentable over *Ridgely '967,* and has rejected claim 8 under 35 U.S.C. 103 as being unpatentable over *Shirokoshi '968.* Applicant respectfully traverses.

The Office Action on Page 3 states that *Ridgely* does not

specifically teach the number of teeth to be 108 or the ratios of the second stage and third stage being 4 and 5.5, respectively.

The Office Action on Page 4 states that *Shirokoshi* does not specifically teach the number of teeth to be 108 or the ratios of the second stage and third stage being 4 and 5.5, respectively.

The Patent Examiner then alleges that it would have been obvious to one of ordinary skill in the art at the time of the invention to modify *Ridgely or Shirokoshi* to employ specific number of teeth and specific ratios, since such a modification would have involved a mere change in the size of a component. A change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 USPQ 237 (CCPA 1955).

A more complete analysis of *In re Rose* is the holding that "there is no invention involved in combining, in appellant's structure, the various known elements and features of the cited prior art in such a manner that these elements and features perform in combination the same function as set forth in said prior art without giving an unobvious and unexpected result. *In re Lindberg*, 39 C.C.P.A. (Patents) 866, 194 F. 2d 732, 93 USPQ 23."

As will now be discussed in greater detail below, there is no concept in the prior art to have a non-whole number variable "i=5.5" in use. Also there is the unobvious and unexpected results that the torque will be 135% over the maximum torque previously available. This clearly points to the nonobviousness of the claimed invention.

According to the present invention, as currently claimed and as briefly summarized, it relates to a

> 3-stage planetary gear mechanism having a tooth number of all the internal geared wheels of 108 and the following particular features in the 2nd and 3rd stage
>
> 2nd stage: 4 planets
>
> $i= 4$
>
> 3rd stage: 4 planets
>
> $i = 5.5$
>
> with i = translation ratio in one stage

In the background of the invention and in the case of planetary gear mechanisms, there are generally valid design guidelines with reference to the following parameters. These parameters include the tooth number of an internal geared wheel, the number of planets in a gear stage, and the number of possible

whole-number translations that can be achieved in a gear stage. These generally known design guidelines are shown in Diagram No. 1. From this, it is clearly evident that in the case of a tooth number of 108 in the internal geared wheel of a gear stage, and three planets, for example, the greatest number of different possible whole-number (integral number) translations, namely 5, can be achieved. The number of possible whole-number translations means that according to the diagram, at an internal geared wheel tooth number of 108 and three planets, a maximum of five whole-number translations can be achieved. This knowledge is part of the general state of the art. This leads to the result that in practice, internal geared wheels with the tooth number 108 are preferably used. This is done in order to thereby achieve a great variability of possible whole-number translations that can be achieved. In the case of an internal geared wheel tooth number of Z = 108 and 4 planets, there is merely a single whole-number translation, according to the information in this Diagram No. 1.

In Diagram No. 2, the number of whole-number translations is plotted on the abscissa, and the number of planets that can be used in a gear stage is plotted on the ordinate. Corresponding to Diagram No. 1, a total of five whole-number translations is possible in the case of three planets in a gear stage,

specifically with i = 3, 4, 5, 7, and 10. This gain applies with reference to an internal geared wheel having 108 teeth. In the case of four planets in a gear stage, only a whole-number translation ratio with i = 4 is possible. In this regard, the content of Diagram No. 2 is also part of the generally known state of the art.

A person skilled in the art of gear mechanisms understands the state of the art on this basis. In practice, fundamentally, whole-number translation ratios between the input and the output are generally desired in gear mechanisms. Thus, a person skilled in the art will generally utilize only whole-number translation ratios in the individual gear stages, exclusively, in each instance. Because to do otherwise, the demand for a whole-number translation ratio number that can be achieved by the gear mechanism overall cannot be met.

The present invention proceeds from this general state of the art as described above. In other words, the present invention describes an improvement upon the technical knowledge of a gear mechanism designer.

In an effort to obtain the greatest possible torque at also the greatest possible translation ratio, with the smallest

possible planetary gear mechanism and the fewest possible gear stages, the inventor investigated the following. It was investigated whether it might be possible to also achieve non-whole-number translation ratios in a gear stage having three or four planets, under the conditions illustrated in Diagram No. 2. In this regard, the inventor found that in the case of a gear mechanism having three planet gears in a stage, other than the previously known five whole-number translation ratios known before the present invention, it was only possible to implement a single other non-whole-number translation ratio with i = 5.5, which can be implemented in terms of structure.

In the case of a gear stage having four planet gears, the inventor determined two additional non-whole-number translation ratios as being possible to achieve by his analysis, specifically the translation ratios i = 3.25 and i = 5.5.

Completely in contrast to the technical knowledge of a gear mechanism designer of ordinary skill in the art, that is usually practiced, the inventor conceived of the present invention. This was accomplished through an investigation of whether the use of a non-whole-number translation ratio of 5.5, for example, in a gear stage having 3 or 4 planet gears, with a planetary gear mechanism having a total of three stages, would make it possible to achieve

unexpected results. An unexpected improvement was made as compared with the generally known state of the prior art, specifically with reference to a higher torque to be transferred. In this regard, the inventor was aware of the practical constraint that he can only make available a gear mechanism with which a whole-number translation between the input and the output can be achieved. Other gear mechanisms would not fall within the general practiced standard and would therefore not find any utility for those skilled in the art.

In order to be able to achieve the requirements of a whole-number translation ratio to be produced, in total, by the three-stage gear mechanism, the inventor investigated what total translation ratio can be achieved at the output of a second gear stage that follows a first gear stage. In this regard, in the case of a three-stage gear mechanism, the aforementioned first stage would be the second stage, and the aforementioned second stage would be the third stage and therefore the last stage.

<u>Diagram No. 3</u> shows the total translation ratios that can be achieved in two consecutive stages of a gear mechanism if a translation ratio has already been achieved in the previous stage. The total translation ratio of such a gear mechanism therefore results from a multiplication of the translation ratio

of the previous stage and the translation ratio of the following stage. In Diagram No. 3, the translation ratio of the previous stage, with which a transition into the following stage takes place, is plotted on the ordinate, while the translation ratio that can be achieved in the following stage is plotted on the abscissa. In the diagram, all possible translation ratios that can be combined with one another in construction terms are entered for those plotted on the abscissa and the ordinate. In this regard, only a total of nine translation ratios that can be implemented by analysis are obtained. A particularly high whole-number translation ratio, with a total translation ratio of $i = 4 \times 5.5 = 22$, is demonstrated by a combination of a translation ratio of $i = 4$ in the front stage and $i = 5.5$ in the following stage. With reference to the invention, the "front" gear stage corresponds to the second (next-to-last) stage of the three-stage gear mechanism there, and the "following" gear stage corresponds to the third and therefore last gear stage (power take-off stage of the gear mechanism).

This results in the first essential inventive step in the case of a three-stage gear mechanism, that of selecting the translation ratio in the next-to-last gear stage as 4, and in the last gear stage as 5.5, in order to thereby obtain a relatively higher whole-number translation ratio, in total of 22. The

actual, fully surprising advantage that can be achieved with the invention is shown by Diagram No. 4.

In this Diagram No. 4, different translation ratios are plotted on the abscissa, and the torque that can be achieved is plotted on the ordinate, as a percent of a maximum torque (100 %)that can maximally be achieved at a specified translation ratio. A maximum torque that can be achieved in a gear stage having an internal geared wheel with 108 teeth and three or four planet gears can be achieved at a translation ratio of i = 5.5. The decrease in the torque that can be achieved at other translation ratios is very clearly illustrated by Diagram No. 4. This recognition of how the highest possible torque can be achieved on the power-take-off side of a two-stage planetary gear mechanism, surprisingly resulted from the inventive discovery by the inventor. This is in contrast to what was previously known in the art of gear mechanisms because the present invention also included non-whole-number translation ratios in the inventor's analysis and calculations, and structure produced.

Furthermore, the inventor was able to find that in a gear stage having four planet gears, as compared with a gear stage having only three planet gears, a significantly greater maximum torque can be achieved. The related increase in the torque is

shown in <u>Diagram No. 5</u>, by means of a comparison of the ratios for three (100%) and four (135%) planet gears in a gear stage, wherein i=5.5.

As the above explanations clearly and convincingly show, the inventor was able to achieve an unexpectedly, surprisingly beneficial result, in total, with the combination of individual, specific gear mechanism parameters he selected, namely the number of planet gears and the translation ratios to be selected in the individual gear stages, with internal geared wheels having a tooth number of 108, in each instance. This result is based on inventive activity particularly because the inventor did not choose only whole-number partial translation ratios in the individual stages, as is generally known, because a whole-number translation ratio is to be achieved between the input and output of a three-stage gear mechanism, in total. Instead, the inventor, in a completely novel and different manner, also utilized <u>non-even-number</u> translation ratios, and thoroughly investigated the resulting consequences and possibilities.

In the case of a planetary gear mechanism with the internal gears with 108 gear teeth, only a maximum translation of i = 4 is possible in a gear stage having four planetary gears, according to previous knowledge and calculation methods.

Here, the inventor has found that in the case of four planetary gears, a translation ratio of i = 5.5 is also capable of functioning, and at the same time, an even number total translation ratio can be achieved. In a three-stage gear mechanism, i = 4 is selected in the second stage and i = 5.5 is selected in the third stage. Four planetary gears in a gear stage result in a particularly uniform load distribution and a high level of resistance of the gear mechanism to twisting, in this range. These properties are particularly important in the last gear stage of a gear mechanism that translates to the slow side, in which the highest torques occur.

The unexpected advantage of the present invention, lies in the fact that despite the use of four planetary gears within a planetary gear carrier of a gear stage with a translation ratio i = 5.5, the use of which is desirable for a uniform and good distribution of force, an increase in the translation, from i = 4 to i = 5.5, which would not have been considered possible, can surprisingly be achieved. In the case of an internal gear tooth number of z = 108 and four planetary gears in a gear stage, it was not possible to achieve translation ratios shown in the enclosed Diagrams. This result was not taught or suggested by the cited references.

In conclusion, the present invention and the pending remaining claims are believed to be patentable over all the prior art references applied by the Patent Examiner whether considered singly or in any combination thereof. A prompt notification of allowability is respectfully requested.

Respectfully submitted,

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Enclosures:
(1) Four (4) drawing sheets: FIG. 1, FIG 2, FIG. 2a and FIG. 2b;
(2) Copy of Petition for 3 Month Extension of Time.
(3) Unexecuted Declaration with Diagrams 1 to 5

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on October 1, 2004.

Maria Guastella

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